



Advanced Speed
Enforcement System

ASES UPDATE

Project Update-March 2005



GOAL: Enhance Safety

Eliminate human error by stopping train before stop required

Provide as soon as possible

Use proven technology



ASES

Similar to AMTRAK's ACSES, but merges
“proven” ATC and SES technologies.

Incrementally installed-builds on existing wayside
investment.

Achieves safety goal.

Core functions need no satellite or radio
infrastructure or on-board database.

Replace/update/expand existing on-board ATC.



ASES Functionality

Provide speed authority enforcement:

- Positive stop-signal

- civil (fixed)

- signal (variable)

- temporary restrictions

Efficiently display speed authorities (SDU).

Function as system speedometer.

Minimal additional wayside infrastructure.



ASES Functionality (cont'd)

Seamlessly operates over various territories:

Non-equipped

Cab signal/ATC only (includes 9-aspect HDIS)

SES-only (existing wayside signal overlay) and against the current of traffic in NORAC rule 251 ABS.

Combined ASES (ATC + SES)

AMTRAK ACSES

“Unknown”

Installation area



ASES Functionality (cont'd)

Automatic freight/passenger characteristics.

Roll-away protection.

Automatic self-test.

Solid-state/microprocessor reliability.

Software-based; allows for future functionality/enhancements/interfaces.

Recurring acknowledge (55-sec./restricting)

Integrated FRA/System event recorder.



Automatic Train Control (ATC) Functions

Provides continuous in-cab speed commands (for signal aspects only).

Ensures response to signal downgrade/overspeed.

Required for operation on AMTRAK NEC.

Uses rails as transmission medium:

100/250 Hz High-level carrier

Uses standard code rates.



Speed Enforcement System (SES) Functions

Transponders at wayside signal locations programmed with fixed & variable (aspect/route) information:

- position tracking based on transponder location input and tachometer inputs

- Profile speed enforcement

- Economical enforcement of civil speeds

 - Permanent (bridges, curves, etc.)

 - Temporary (work areas)

Positive Stop:

- Home Signal displaying Stop or Restricted-Unique Pass Stop Codes

- First Automatic Signal displaying Stop & Proceed

 - SES requests Train Stop Penalty at subsequent Automatic Signal displaying Stop & Proceed if the Locomotive Engineer fails to stop prior to the signal.



Project Summary

5 years late...and counting (planned for 2!)

Technology *not* previously fully integrated. Major technological challenge; not really “proven” because our requirements were more severe.

Original software was difficult to modify; now modular with “growing pains”.

“Technology Transfer” issues.

Monthly “Workshop” meetings to resolve remaining issues.

Future enhancements (ACSES-driven)



Transponder Types

Passive transponder:

a stand-alone device; energized by passing train to send 255-bit telegram.

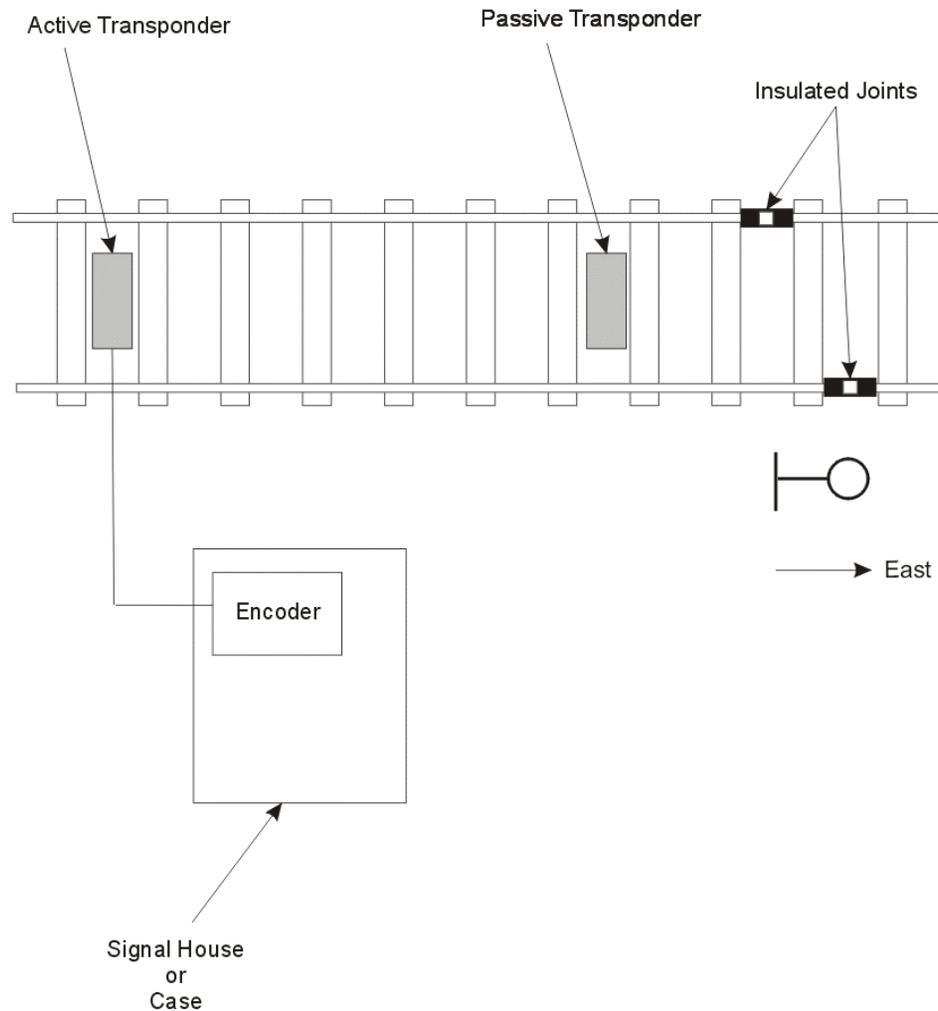
always transmits its *resident* telegram to train.

Active transponder:

Same device as passive, but connected to an encoder that supplies variable telegrams that correspond to input conditions (signal aspects).

Transmits *default resident* telegram if the encoder or associated component, such as the connecting cable, fails.

Transponder Group





Transponder Data

Transponder positioning & linking

Configuration of transponder group

Territory

LoA (signal aspect & type, gradient, target speed & type, distance to target & increase, route)

Civil restrictions

Installation area identification



Transponder Bit Assignments

- Coordinated with Alstom for ACSES
- Preserve future undefined functionality
- Allow distinguishing among train types
- Unique identification of location
- Duplication within group of certain information
- Up to 4 transponders in group



Territories/Modes of Operation

Unknown: provides control at start up (cab keyed on), power reset, and predefined system exit areas; enforces a 10 mph speed limit

Non-equipped: supervises 79 MPH MAS

Cab signal: Enforces speed limits associated with 9 valid 100/250 Hz codes transmitted through rails

SES-only: enforces wayside signal, civil restrictions, and territory type status from active & passive transponders at all signal locations



Territories (cont'd)

Combined: active transponders at distant and home signals; passive transponders at all signal locations provide positioning information for distance tracking, fixed civil restrictions, and territory type data. Cab signal code inputs used in conjunction with transponder information to provide *continuous* speed enforcement.

Installation Area: defined speed enforced within a defined maximum distance. All other information ignored (Cab & SES). Avoids need to cut system out during construction.



Territories (cont'd)

ACSES: Reads AMTRAK's transponders and properly responds and enforces civil speeds and positive stops.

Freight/Work Mode: Allows freight locomotives to perform shifting moves over transponders at restricted speeds without penalty. Avoids need to cut system out while shoving with work or local freight train operation.



ASES Implementation

Vehicle installation off-site

2 week turnaround

Wayside installation in stages

Temporary freight train operational waiver

Software versions (ACSES volatility, problem resolution)



ASES Delay Issues

FCC License (Temporary, Permanent new rules with HSRC, Retest & Resubmit)

Integration of SES with ATC

Limited on-board “real estate”

Additional functionality for operation in *all* territories

Modeling with new Hardware & Software Simulator

New Graphical SDU flat panel display

Precision of ROW information

Software & Hardware “V&V”, reliability, and ACSES Compatibility!!

FRA recorder integration

Custom requirements of individual vehicles (vs. trains)

Technology transfer



CURRENT Contract

Phase I – Demo

Phase II –

Install SES only on Pascack Valley Line

Design Main Line

Install ASES on trains for NEC HDIS operation

**Phase III – Install ASES on remainder of
system**

ASES PROJECT

Not to scale

Legend

- MN/NJT Jt. Service
- SES Territory
- ATC Territory
- Amtrak connection
- ASES Designed
- Light Rail
- PATCO
- PATH
- Other connecting service





NJT Project In Service

SES in revenue service only on Pascack Valley Line:

- 13 trains (GP40s and COMET 1 & 5 Cab Cars)
- 26 trips a day
- 23 miles of SES-equipped single track:

No Cab Signals (except 1-mile)

97 Transponders & 33 Encoders

SES providing stand-alone car-borne ATP:

Signal enforcement & Positive stop

Line Speed

Civil Speed



ASES Onboard Status

SES Installed:

100 Arrow-III EMU Married Pairs & 30 Arrow-III EMU Singles
13 GP40PH-2 & 2 Metro-North F40PH-2 CA Diesel-electric locomotives
13 Comet 1 & 21 Comet 4 Cab cars
29 ALP-46 Electric Locos
99 Comet 5 Push-pull Cab cars

Remaining Installations*:

32 ALP-44 Electric Locos
74 Diesel-Electric Locos
45 Comet 1 Push-Pull Cab cars

Planned for all new vehicles:

33 PL42AC Diesel-Electric Locos (2005)
15 Bi-level coach Cab cars



ASES Wayside Status

**Wayside SES design for Main/Bergen
Lines 100% complete*:**

To be installed for revenue service when vehicles available

Design for Remainder of System ~60%

Now 91.5% Cab Signal (ATC):

Not planned for original project

Moved ahead due to other project delays

Remainder complete in next 2 1/2 years



ASES Project Status

On board software rewritten; tested 2004

Reliability Demonstration underway (HW & SW):

Weekly progress report/analysis

*Installations on hold pending successful demo

Freight/Work Mode tested; revenue ready 2005

AMTRAK ACSES Compatibility:

Functional tested 2004

AMTRAK demo & revenue-ready 2005



SDU Features

Graphical & User-friendly:

Design/operations team did not want crews to “fly the screen”

Integrate all User I/O functions:

Speedometer

Current *and* Target Speed authority

Distance to go

Alarms & messages

Numerical keypad

No signal *Aspects*

Fit existing space in cab cars & MU's

Reliability enhancements in progress

What the “Speed Display Unit” shows

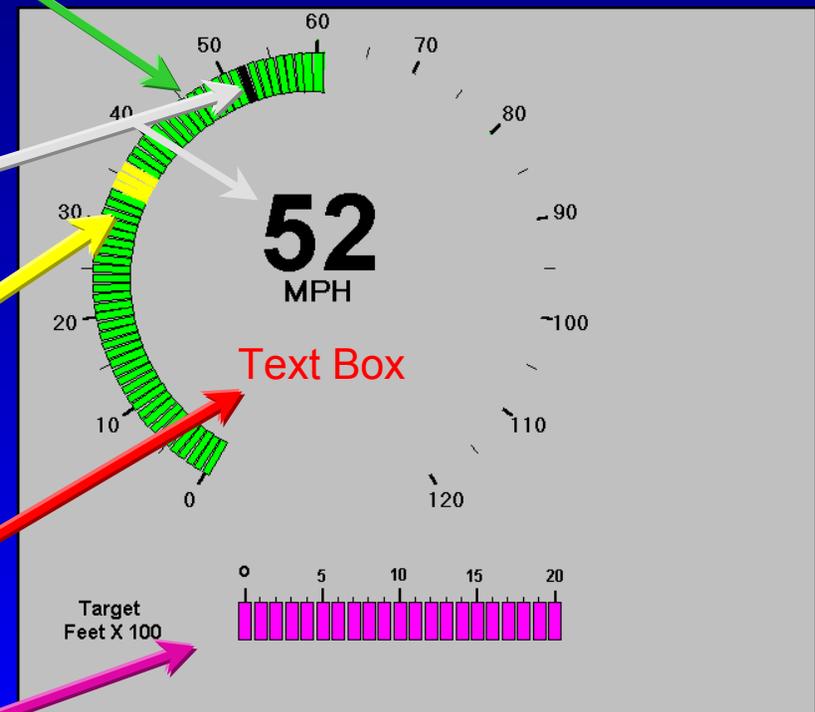
Green band shows maximum authorized speed

Black mark and numerals show current speed

Yellow band is target speed being approached

Red text box displays system messages

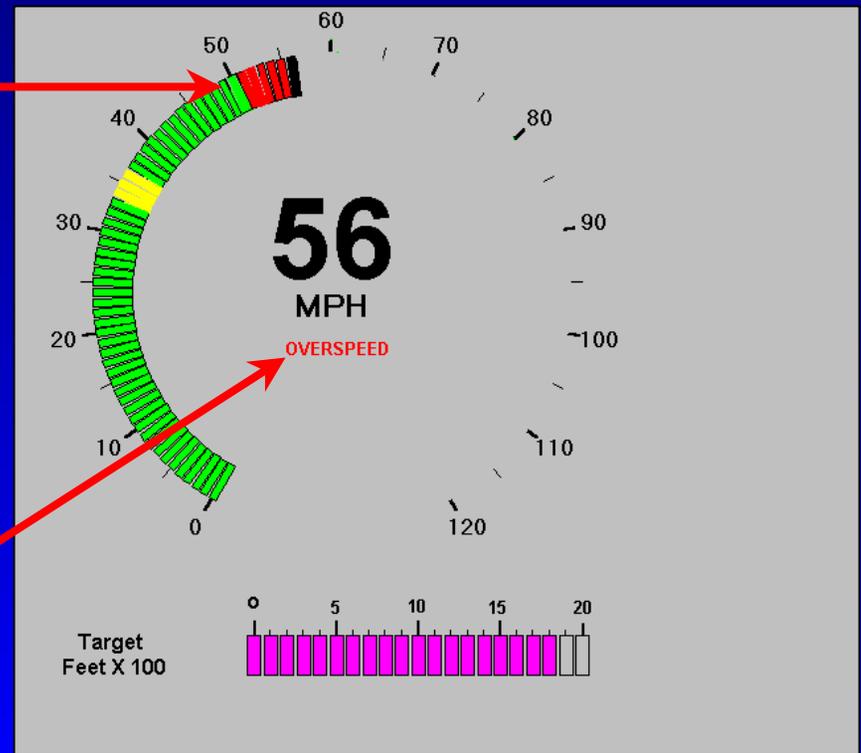
Magenta band shows distance to the target



SDU Overspeed Display

Approaching Target

- **Speed** band will turn **red** above the instantaneous authorized speed calculated from braking profile
- **“Overspeed”** text is displayed
- **Sonalert** sounds





Questions?

